DOCUMENT RESUME

ED 194 189 PS 011 778

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TITLE Conservation of Senegalese Youth and Its Psycho-Social Correlates.
PUB DATE Feb 80
NOTE 19p.; Paper presented at the Annual Interdisciplinary UAP-USC International Conference on Piagetian Theory and the Helping Professions (10th, Los Angeles, CA, February 1-2, 1980).

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Adolescents; Age Differences; *Children; Comparative Analysis; *Conservation (Concept); *Environmental Influences; Family Characteristics; Foreign Countries; Intelligence; *Maturity (Individuals); Physical Characteristics; Rural Urban Differences; Sex Differences; *Social Influences
IDENTIFIERS Piagetian Tasks; *Senegal

ABSTRACT

The purpose of this study was twofold: (1) to investigate the appropriateness of Piagetian tasks for a comparative assessment of the cognitive development of rural and semi-urban Senegalese youth; and (2) to determine relationships among selected social and environmental factors affecting Senegalese youth. Fifty semi-urban and 50 rural area Senegalese children (64 males and 36 females) ranging in age from 6 to 15 years were individually administered five conservation tasks involving number, substance, and weight. Subjects' intelligence was assessed with the Goodenough Draw-A-Man Test (Harris, 1963) and by the Sills Electric Analog Test. Information relating to the children's family and living situation, and the effect of nutrition on their development was obtained through an interview and by measuring height, weight, and arm size of the children. Results indicated that maturation variables (years in school, height, intelligence, weight and arm size) were significantly related to all measures of conservation. However, when age was partialled out of these variables, none of them were found to be correlated with any measures of conservation. Social variables such as family size, number of wives of the father and number of rooms in the child's home were also found to be related to conservation. It was concluded that these results lend further support for the appropriateness of Piagetian tasks for a comparative assessment of the cognitive development of rural and semi-urban Senegalese youth. (Author/MP)

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# Conservation of Senegalese Youth and Its Psycho-Social Correlates

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The importance of cross-cultural Piagetian research has been demonstrated in the increased number of studies during the past two decades. While this may be attributed in part to the issue of "culture-free" standarized tests, there has been a continued interest in the problem of whether logical thought develops similarly in different cultural settings.

Descriptive cross-cultural studies have corroborated the sequence of Piaget's stages of cognitive development (Bovet, 1976; Dasen, 1972). The horizontal decalages as the sequential conservation of mass, weight and volume have been documented with groups but not necessarily with individuals (Bliss and Docherty, 1979). Some comparative studies have noted variable time differences between children in traditional Western societies and those from non-Western societies; the latter represented a slower rate of development (Bovet, 1976; Dasen, 1972; Greenfield, 1966, Heron and Simonsson, 1969). In contrast, there are other studies in which no differences in attaining conservation between children from Western societies and those from different cultural situations were reported (Brekke, B.W., Williams, J.D., Brekke, A.G., 1977; Goodnow and Bethon, 1966; Price-Williams, 1961).

Within - group studies of non-Western cultures have indicated differences resulting from the effects of schooling versus non-schooling (Bovet, 1976; Dasen, 1972; and Greenfield, 1966). On the other hand; it was found that schooling has little effect upon conservation (Fahrmeier, 1978).

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In a study of schooled and unschooled Tanzanian children, Nyiti (1976) observed the pattern of the development of conservation to be similar for both groups; their performance for substance was comparable to that of the Wolof children in Greenfield's (1966) study.

Moreover, the question of the effects of urban versus rural situations upon schooled children has been examined by Omari (1975). He found no differences among Tanzanian subcultural school groups from urban, open terrain, and remote rural areas. The slower rate of attainment of spacial concepts by all children was attributed to general environmental factors as lack of technological influence, inadequate school facilities, different cultural stimulation, and maturation rather than to specific ecological effects.

The purpose of this study was twofold: (1) to investigate the appropriateness of Piagetian tasks for a comparative assessment of the cognitive development of rural and semi-urban Senagalese youth and (2) to determine the relationships among selected social and environmental factors of the Senegalese youth.

## METHOD

### Subjects

One hundred Senegalese children were tested in the present study, of which 50 were drawn from a semi-urban and 50 from a rural area. The subjects (64 males and 36 females) ranged in age from 6 to 15 years with a mean chronological age of 10 years and 5 months. The ages were reported by family members and orally verified by elders of the community, who observed the testing. However, the accuracy of the ages were not possible to ascertain due to a lack of records. Although the mean number of years of schooling of the children was 2.16 years, seven of the 50 semi-urban subjects and 22 of the 50 rural subjects had never been to elemen-

tary school. The mean number of years of schooling of the parents was .60.

Population

Semi-urban. The semi-urban population sample was drawn from Bargny, a suburb of Dakar. Most men worked as laborers in factories, office clerks, and some as farmers or fishermen. A small number of women were self-employed as traders of food and household items. Running water and power were available in some homes. Both private and public transportation were commonly used by the population. The children had access to French language schools, which were under the central authority of the ministry of Education and modeled on the French education system in specific curriculum and structure. This influence has continued despite Senegal's political independence from France in 1960. Also, Koranic school was attended by some girls and all of the boys at six to eight years for religious instruction since Senegal is a Moslem country.

Rural. The children in the rural area resided in M•Bidieum, a remote village of three hundred people. Most men were farmers engaged in a subsistance level of agriculture with simple tools as a hoe.

Although peanuts were raised for income, millet and other vegetables were grown for food. Water was obtained from a communal village well and no electric power was installed. Public transportation was offered on a limited basis and private vehicles were uncommon. All of the boys and some girls attended a Koranic school in the village, and 22 traveled several miles each day to the nearest village for elementary school.

Procedures

Arrangements for the research were facilitated by the "Environment Training Programme", ENDA, which is a joint project of United Nations' Environment Programs and Swedish International Development Authority. A social worker from ENDA accompanied the first author and the interpreter to meet with the headmen at Bargny and M•Bidieum. The project was explained and permission for testing on a voluntary basis was secured. A second meeting was held at M•Bidieum for community approval. The headmen and other significant adults in the community as well as the parents observed the testing, which became a group experience rather than the usual experimenter/child situation.

The procedures consisted of an interview about the child's family and living situation; measurements of height, weight, and arm size; Goodenough Draw-A-Man Test (Harris, 1963) of a man, woman, and the child; conservation tasks of number, substance, and weight; and the Sills Electric Analog Test. The first author was assisted in administering the procedures in Wolof by an interpreter, who spoke Wolof, French, and English. Also, young adult male from Bargny helped with obtaining physical measures (height, weight, the child's arm) in both communities. Additionally, a College of Bargny mathematics teacher was present and was supportive of the testing procedures in Bargny.

The interview about the child's family and living situation included the following information: age, number of years in elementary school of the child, sex, right or lefthanded, the total number of family members living in the compound, number of wives of the father, number of children of the child's mother, birth order of the child, employment of the father

and mother, education of the parents in French language school and Koranic school, roof and wall materials of house in the compound and number of rooms in the house. The answers of the children were confirmed or clarified by other family members as (parents or older siblings) and respected elders present.

In the family situation the extended family lived in a family compound with the head of the compound, his wives, his children, and the wives of his children. The compound was made up of several micro-family units living in houses within an enclosure. In the rural area the traditional houses had thatched roofs and walls of thin poles or woven mats. Some houses had tile or zinc roofs and concrete walls. In the semi-urban area, most of the homes in the compound were constructed with tile or zinc roofs and concrete walls.

Intelligence was assessed by the Goodenough Draw-A-Man Test (Harris, 1963), since it is said to provide a nonverbal measure for the child of a non-Western culture.

Conservation of number and substance tasks were individually administered to each child. The procedures were organized into five tasks to assess the child's acquisition of conservation as follows:

> Task I. Conservation of Inequality of Number with 11 light blocks and 9 dark blocks of equal size. A starting position of inequality is established by the subject. Next, a transformation was made by pushing the sets of blocks into two separate bunches. Then the subject is asked. "Are there more light blocks, more dark blocks, or the same number of light and dark blocks?"
>
> Task II. Conservation of Equality of Number with 10 light blocks and 10 dark blocks of equal size. After the subject makes a one to one correspondence of equality, a transformation is performed by pushing the light blocks close together and stretching the dark blocks out in lines. The subject is questioned, "Are there more light blocks, more dark blocks, or the same number of light and dark blocks?"

Task III. Conservation of Equality of Substance with two equal-sized clay balls: The subject established that the two balls of clay are the same size. Then he/she transforms one ball into a sausage shape and is asked, "Which has more, or do both have the same amount?"

Task IV. Conservation of Inequality of Substance with two unequal-sized balls: After the subject determines that one ball has more, the smaller ball is transformed into a pancake shape by the subject. Then he/she is questioned, "Which has more, or do both have the same amount?"

Task V. Conservation of Equality of Substance with two equal-sized balls: The subject identifies the balls as being the same size. Then he/she transforms one ball into little pieces. He/she is asked, "Which has more, or do both have the same amount?"

The child was queried, "How do you know?" after each transformation answer. The resulting justification clarified the response as either conserving or nonconserving.

For each task a conservation response was scored 1, and the total possible conservation score for each child was 5. Nonconservation responses were scored zero. A child who succeeded on all five conservation tasks was defined as a conserver. A child who responded inconsistently and did not acquire conservation was considered to be a nonconserver.

The conservation of weight tasks in the study were modifications of the series of thirteen steps formulated by Furth (1964) in his investigation of the thinking processes of deaf children. The sequence of steps was retained, but the nonverbal presentation was adapted to a verbal procedure in a study of conservation of weight with blind children by Brekke, Williams and Tait (1974). The thirteen steps were:

Step 1 Two similar balls.
Step 2 One ball - one snake.
Step 3 One snake - half a ball.
Step 4 Two similar balls.
Step 5 One whole ball - two halves of the other ball.
Step 6 One whole ball - one half ball.
Step 7 Two similar balls.

| | |
|---|---|
| Step 8 | One ball - one ring |
| Step 9 | One disc - one ring |
| Step 10 | Half ring - half disc |
| Step 11 | Half ring - half disc in one hand and the same in the other. |
| Step 12 | One ball - half ring. |
| Step 13 | Two similar balls. |

The crucial test for the acquisition of conservation were steps 2, 8, and 9 according to the criteria established by Furth. For each step, one of the two equal-sized balls was transformed into the shapes of a snake, ring, and a pancake. Conservation of weight was tested by questioning, "Do they have the same weights or different weights?" All subjects were asked, "How do you know?" for the transformation steps 2, 8, and 9. The justifications contributed to the classification of the responses as conservers of nonconservers. Equal-weight balls were used in steps 4, 5, 7, 10, 11 and 13. Steps 3, 6 and 12 were designated as control measures to check on a consistent "same weight" response being correct. These procedures were given to the subjects on an individual basis. A subject was considered to be a conserver if he was successful on all three critical steps (steps 2, 8, and 9).

The Sills Electric Analog is a unique device developed by Sills (1975) to serve an as analogous test to the much more time (and material) consuming combination of chemical bodies Piagetian task (Sills and Herron, 1977). With the Sills Task, the subject is shown a small device with four push buttons and a light; with the buttons hidden from the subject's view, the light turns on with the examiner manipulating the buttons. The subject is then asked to make the light turn on. No single button will turn the light on: two different combinations, one with two buttons depressed and one with three buttons depressed, are necessary to turn on the light. The subject is scored in the manner that the task is approached

(either systematic or random). The subject can score from 1 (Concrete IIa, wherein only one button is depressed at a time and even upon prompting successful combination is found) to 10 (Formal IIIB, wherein the subject systematically tries all combinations and confidently concludes that only the two combinations produce the light).

A procedural problem arose when the testing appeared to become a cooperative social situation with the children sharing their experiences about the Piagetian tasks. It was observed that some of the children said the answers before the questions were asked. Therefore, several modifications were necessary as changing the color of the blocks and rotating the Sills Electric Analog device around to reverse the order of the buttons. These slight changes influenced the children to rely upon their own judgments rather than use information from each other.

In scoring the Draw-A-Man Test several cultural commonalities were observed. Many of the children in the rural area did not wear shoes and drew bare feet with toes on their figures: others depicted the figures in traditional style of dress: Because of the shaven head custom for males, children from both areas drew figures without hair. Some children showed the genital organs in specific detail and many did not put ears on the heads, even the older children. It was unexpected to find few mouths drawn in two demensions as well as numerous heads with noses but no mouths. Usually the first of the three figures was scored.

The measurements of height, weight, and arm size were made to examine effects of nutrition in the semi-urban and rural areas. In both Bargny and M•Bidieum the first author was given similar food by families. It consisted of rice, fish, and vegetables mixed together as a noon meal. Millet was prepared in a warm cereal form in the evenings and beverage with bread was eaten in the morning.

## RESULTS AND DISCUSSION

Table 1 reports a considerable number of variables and their correlations with the three measures of conservation. Not reported in Table 1 are the correlations with age: the correlations are, respectively, conservation of number and substance with age, $r = .67$; conservation of weight with age, $r = .54$; and, Sills Analog with age, $r = .67$. Because age not only correlates with conservation but also naturally correlates with other maturation variables (years in school, height, intelligence, weight and arm size), age was partialled out of these maturation variables so that their relationship with conservation would not be age dependent. All maturation variables are significantly related to all measures of conservation ($p < .01$); after the partialling of age from the maturation variables, none are significantly correlated with any measure of conservation, though intelligence approaches significance on two of the measures.

Sex is significantly related with two of the three measures with males performing somewhat higher. Of the remaining variables, two show significant correlations with conservation. Number of wives of the father showed a significant positive relationship to all three measures of conservation. Number of rooms in the immediate house of the child showed a significant relationship with the Sills task and positive relationships to the other two measures of conservation. In regard to housing materials, there were 66 tile, 18 concrete, and 16 zinc or thatched roofs. Ninty-six of the houses had concrete walls, three had wood, and one had woven mats. The type of roof and wall materials had no significant effect upon conservation.

TABLE 1

Relationships Among Three Measures of Conservation and Several Social - Psychological Variables with Senagales Youth (N = 100)

| | Conservation of Number & Substance | Conservation of Weight | Sills Analog |
|---|---|---|---|
| Sex (1 = Male) | .21* | .08 | .25** |
| Handedness (1 = Left) | .04 | -.18 | -.07 |
| Years in School | .48** | .35* | .42** |
| Years in School (.Age) | .10 | .02 | .02 |
| Semi-Urban - Rural | .03 | .06 | .06 |
| Height | .61** | .45** | .62** |
| Height (.Age) | .00 | -.10 | .05 |
| Intelligence | .57** | .48** | .51** |
| Intelligence (.Age) | .18 | .17 | .11 |
| Weight | .48** | .41** | .56** |
| Weight (.Age) | -.15 | -.08 | .00 |
| Arm Size | .41** | .31** | .49** |
| Arm Size (.Age) | -.11 | -.12 | .01 |
| Number of People in Compound | -.01 | .00 | .00 |
| Number of Children Same Mother | .10 | .00 | -.04 |
| Birth Order | -.02 | -.10 | -.13 |
| Number of Wives of Father | .25** | .21* | .23* |
| Years Father's Education | -.15 | -.12 | -.14 |
| Years Mother's Education | -.03 | .07 | -.01 |
| Years Father's Koranic Education | .03 | .15 | .14 |
| Years Mother's Koranic Education | -.16 | -.09 | -.11 |
| Number of Rooms in House | .18 | .11 | .27** |
| $R_1$ | .71** | .60** | .74** |
| $R_2$ | .47 | .44 | .47 |

* $p < .05$

** $p < .01$

Although no significant differences among the various occupation groups were found in terms of conservation, all of the fathers in the rural area were farmers and ten were farmers in the semi-urban area. Factory workers and office clerks were the next most frequent vocations of fathers in the semi-urban area. All of the mothers in both areas were housewives with the exception of seven, who were traders.

TABLE 2

The Relationship of Intelligence, Years in School, Parents Years in School, Size of Community, Physiological Variables and Social status with Conservation Independent Contribution

| Variables | Conservation of Number & Substance | Conservation of Weight | Sills Analog |
|---|---|---|---|
| Intelligence (Age) Years in School (Age) | .01224 | .01518 | .00552 |
| Parents Years in School | .02294 | .04814 | .03002 |
| Semi-Ruban-Rural | .01057 | .00019 | .00163 |
| Height (Age); Weight (Age); Arm Size (Age) | .02064 | .03521 | .00474 |
| Number of Wives of Father; Number of Rooms in House | .06386* | .03835 | .05342 |
| R | .38117 | .37720 | .32193 |

* $p < .05$

Table 2 reports an analysis using five sets of variables selected from those found in Table 1. The two sets that appear to show the highest independent contribution are parents' years in school (father's years in school, mother's years in school) and the combination of number of wives and number of rooms in the house. Both of these variables would likely be representative of socio-economic states. While only

the latter set shows a significant independent contribution to any of the measures of conservation (and then only with conservation of number and substance), this set does consistently make larger independent contributions than the other sets of variables. The semi-urban-rural variable makes only minimal independent contributions to the three measures of conservation. After the effect of ages is removed from the physiological variables and the intelligence-school variables, little independent contributions remain. Again, the importance of the set including number of wives and number of rooms in the immediate house of the child is underscored.

Clearly, these are social variables unique to a Moslem culture and not transportable to a Western culture. Insofar as these variables reflect a socio-economic base, that is, presumably the likelihood of plural wives increases as the father's relative economic status improves; also, a house within a compound with more rooms would be indicative of a higher social standing. One might also envision an additional value to the concept of plural families within a single compound. If the families (actually, one family, since one father is involved) are cooperating within the compound, a child is more likely to interact with several adults rather than with the mother and father only.

Implications of Results:

Almost all of the children who gave consistent conservation responses were 10 years of age or older. This is not unusual when compared to data from other non-Western cultures. It can be concluded that this investigation lends further support for the appropriateness of Piagetian tasks for a comparative assessment of the cognitive development of rural and semi-urban Senegalese youth.

As age was seen to be a very likely correlate of conservation, age was partialled out of several maturation variables, and also partialled out of years of schooling. In this sense, the maturation variables and combined intelligence - schooling variables were found to have little effect upon conservation.

The effect of the social type variables bears somewhat more of a relationship with conservation. It does appear that the number of wives of the father and number of rooms in the immediate house of the child are related to conservation. It is possible that the children from families where the father has several wives would benefit from the increased social interaction of the large family in the compound. This type of family arrangement would seem to be more likely to provide a stimulating environment than would a nuclear family in the Western sense.

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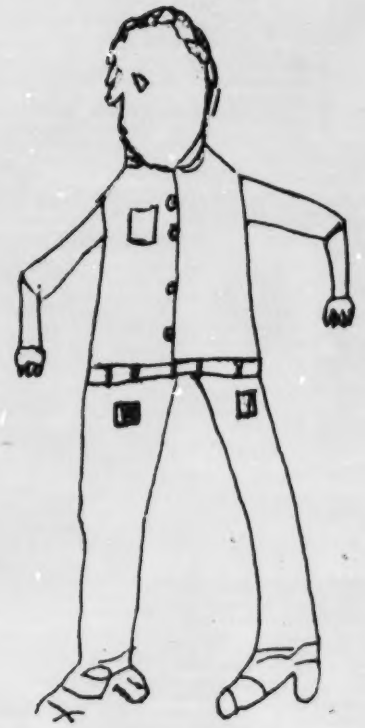
Name/Nom
Code Number/Numero d'enquêt
15 years

1) Dessiner un homme entier/Draw a man
2) Dessiner une femme entière/Draw a woman
3) Dessine toi toi-même/Draw yourself



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